THE EFFECTS OF FEEDING *Balanites aegyptiaca* AND MIXTURES OF *Balanites aegyptiaca* AND *Ziziphus Mauritania* ON NITROGEN INTAKE AND RETENTION BY GOATS

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ABSTRACT

*A digestibility trial was conducted to determine the effect of feeding browse mixtures on nitrogen retention and intake in goats. Four goats with a mean live weight of 15.75kg 0.5 were randomly assigned to four treatments in 4*4Latin square design. Each period lasted for 14 days. The treatment group were: Balanites only Ziziphus at in addition, Water and mineral salt lick were provided ad-libitum. Dry matter intake showed significant differences (P<0.5) among the treatments. Goats on treatment B, C and D had similar (P>.05) dry matter intake while goats fed on treatment A had the lowest dry matter intake. The daily live weight gains were 107.05, 35.00 and 40.00g/day for A,B,C and D. Nitrogen intake differed significantly (P<0.05) between treatment D had the highest Nitrogen intake and treatment A had the lowest Nitrogen intake (8.39g/day). Faecal nitrogen output differed significantly (p<0.05) between treatment A, B, C and D The faecal Nitrogen was lowest in animals fed treatment and the values were :1.56,7.22. 7.53 and 11.09g/day for treatment A, B, C and D respectively. In conclusion feeding Balanites aegyptiaca and Ziziphus Mauritania in the ratio of 1.1, 12 and 1:23 improved nitrogen intake on goats compared to Balanites aegyptiaca alone.*

INTRODUCTION

One of the major limiting factors to animal production in the semi-arid region of Nigeria is nutrition during the dry season; the natural pastures and crop residue available for ruminant animals are low in crude protein and high in figure. These factors reduce voluntary intake and digestibility.

Browse plants play a significant of ruminant lives livestock in tropical regions. Browse species, because of their resistance to heat, drought, salinity, drifting sand, grazing and repeated cutting, are the major fed resources during the dry season (Njidda *et al*2010) The tree and shrub legumes are rich in most essential nutrients such as protein and minerals and tend to be more digestible than grasses and crop residues. They also serve other useful purpose such as the provision of food, drugs life wood a building poles and recycling of nutrients (Abdullahi *et al*., 2017). Browse plants, beside grasses, constitute one of the cheapest sources of feed for ruminants. The diversity and distribution of browse plants in Nigeria have received early attention in studies carried out for the north (Njidda *et al*., 2012), southwest (Ajala., *et al*., 2019) and middle belt (Ibeawuchi., *et al*., 2016). Feed potential of browse in the diet of herbivores in Nigeria is reflected in report of (Ertop., *et al*., 2018).Although, there are many advantages of forages and leguminous crops over tree crops, the leaves of certain trees can be as nutritious as those of fodder legumes (Arina., *et al* 2019). Several tree species could be effective source of providing further nutrition during normal as well as scarcity period (Dereje, 2016). However tannins found in some browse trees and shrubs may reduce intake and digestibility in ruminant animals. High levels (63-106g/kg DM) substantially depressed feed intake and digestibility in sheep. Low levels (30-40mg/g DM) of tannins have nutritional benefit for ruminant by protection dietary proteins from excessive ruminal degradation without affection forage intake or fiber digestion (Njidda *et al*., 2013). Obua *et al*., (2014) reported that the daily weight gain of animals supplemented with the mixture of *leucaena* and *calliandra* was higher than those animals supplemented with *Calliandra* only. Dereje *et al*., (2015) reported higher dry matter intake and daily weight gain in West Africa Dwarf Goats fed *Gliricidia* and *leucaena* mixture than *Gliricidia* alone. There is little information on nutritive value of mixture of browse leaves in the semi-arid region of Nigeria. This study aimed at determining the chemical composition of browse mixtures and nitrogen utilization by goats fed browse mixtures as sole diet.

MATERIALS AND METHODS

The experiment was conducted at the University of Maiduguri Teaching and Research Farm. Maiduguri being the Borno state capital lies on latitude 11°5' North and longitude 13°9' East (Encarter, 2007); and located within the semi-arid zone of West Africa. It is characterized by a short rainy season of 3-4 months (June- September)

and a long dry season of about 8 month's duration (Ibrahim et al., 2016). The ambient temperature could be as low as 20c during the dry cold (October to January) season and as high as 44°c during the dry hot (February to May) season. Relative humidity is 5% in April and May. Day length varies from 11-12 hours (Raji *et al*., 2019). Four goats of mixed breed weighing averagely 15.75kg±0.5 were used for the study. The animals were weighed and randomly assigned to 4 treatments in a 4x4 Latin square design (LSD) with 4 periods. Each period lasted for 14 days. The experiment was conducted from
December, 2012 to May, 2013. Animals were fed Balanites aegyptiaca leaves alone (control), and Balanites leaves mixed with Ziziphus leaves at ratio of 1:1, 1:2 and 1:3.
The treatments were:
A; *Balanites* leaves (control).
B; *Balanites* and *Ziziphus* leaves (1:1).
C; *Balanites* and *Ziziphus* leaves (1:2).
D; *Balanites* and *Ziziphus* leaves (1:3)
The layout of the experiment is shown below:

Animals Tag No			**period**	
	1	II	III	IV
248	A	B	C	D
390	B	A	D	C
224	C	D	B	A
382	D	C	A	B

4 Treatments, 4 Animals, 4 Periods

The leaves of *Balanites aegyptiaca* and *Ziziphus mauritania* used for the study obtained within the University of Maiduguri. The leaves of the browse plants were obtained by lopping the branches. The lopped leaves were air dried for 2-4 days and thereafter the branches were shaken to remove the leaves. The leaves were collected and stored in bags for the study. Prior to the commencement of the digestibility trial, all animals were dewormed against Internal parasites with Albendzole Bolus (Albanet 250mg) which was orally administered. Animals were weighed and randomly assigned to 4 treatment groups. Each animal was housed in individual metabolism cages that facilitate separation of faeces and urine. Browse leaves were weighed daily before feeding to the animals. Feeding was done once daily at 7:00am. Animals were fed *Balanites aegyptiaca* leaves alone (Control), *Balanites* leaves mixed with *Ziziphus* leaves at ratio of 1:1, 1:2 and 1:3. They were fed for 7 days adaptation period followed by a 7 days collection period. Refusals were collected and weighed so as to determine the amount consumed by the animal. The browse leaves fed at 4% of the body weight. Water and mineral salt licks were provided ad-libitum. The feed samples were collected and bulked for proximate analysis. During the collection periods, total faecal output was determined for each animal. Faeces were collected and weighed, sub-sample was taken and oven dried at 105°c for 24 hrs to determine the dry matter (DM) content. Sub-samples of the faeces taken and bulked for proximate analysis. Daily urine output was determined from each animal and sub-sample of the urine were taken and kept in bottles containing of 10mls Conc. H_2SO_4. The urine was bulked and kept for Nitrogen determination. Animals were weighed at the beginning and end of each collection period.

Data Collection

Feed Intake

This was determined by subtracting the left over (W) from the feed given (w)) daily.
Feed intake = W1-W2
Where:
W1- Feed givet
W2- Refusal/ left over

Body Weight Gain. (BWG)

This was obtained by calculating the difference between the live weight at the beginning and end of each collection period.

Feed Conversion Ratio (FCR)

This was determined by dividing the fecd intake per animal in grams by the body weight gain of the animal

$$FCR = \frac{\text{Feed intake (g)}}{\text{Weight gain (g)}}$$

Dry Matter Digestibility (DMD)

This was determined using the formula:

$$DMD = \frac{DM - DMFO}{DMI} \times 100$$

Where:

DMI= Dry matter intake.
DMFO-Dry matter faccal output.
DMD=Dry matter digestibility.

Chemical Analysis

The samples collected were analyzed for dry matter (DM), moisture content (MC), crude protein (CP), crude fibre (CF), fat (EE) and ash. Urine samples were analyzed for nitrogen
(AOAC, 2002).

Dry Matter (DM).

This was determined by weighing 10g of each sample into labelled and weighed
Petri dishes. The Petri dishes were oven dried for 24hrs at 105°c ± 2°c until a constant weight is obtained.

$$\%DM = \frac{W1-W2x\ 100}{W3}$$

Where:
WI- Weight of sample before oven drying
W2- Weight of sample after oven drying
W3- Weight of sample used.

Fat (EE)

The ether extract was determined by soxhlet method. 2g of each sample was used for the fat extract using the soxhlet apparatus. The EE content of the samples was determine by
weighing each empty container before petroleum ether was poured in to container which contain the sample folded in the filter paper. The container apparatus is set on heating mantle to extract the fat. After the extraction the petroleum ether was recovered and the fat dried.

$$\%\ FAT = \frac{W-\ W2\ x\ 100}{W3}$$

Where
W1- Weight of container after oven drying.
W2- Weight of empty container before oven drying.
W3- Weight of sample used.

Crude Protein (CP).

The percentage crude protein of the samples was determined using the standard Kjedahl
procedure. lg of each sample was digested in concentrated sulphuric acid with Kjedahl tablet.
The digests were then dıstillated using distillation machine and then finally titrated with 0.1N
Hcl.

$$\%CP = \frac{(A-B)\ x\ 0.1N\ X14{,}007X6.25x100}{Mg\ of\ sample\ used\ (1000)}$$

Crude Fiber (CE).

The method used was the trichloro-acetic acid method. 2g of sample was weighed into a 500ml conical flask and 100ml of digestion reagent was added. The digestion reagent was
prepared by mixing 500ml of glacial acetic acid, 450ml of distilled water, 50ml of concentrated Nitric acid and 20g of trichloro-acetic acid. The flask containing the sample and the digestion reagent was boiled and refluxed for 40minutes. It was then removed from the heater and cooled under a tap and then filtered with a filter paper. The sample on the filter paper was washed several times with hot distilled water to remove carbohydrate and protein, then once with petroleum ether to remove the fat. The filter paper containing the sample was oven dried over night at 105°c.
The sample was then ashed in muffle finance at 60c for 6hours. The crude fibre was
calculated by using the formular:

$$\%Fibre- \frac{(W-\ W2)\ x\ 100}{Weight\ of\ sample\ (2g)}$$

Where:
WI- Weight after oven drying.
W2- Weight of ash

Data obtained were subjected to analysis of variance (ANOVA) using the statistix 8.0.

RESULTS AND DISCUSSION

The chemical composition of the browse plants used for the study is shown in Table 4. The dry matter contents were 95.4% and 96.6% for *Balanites aegyptiaca* and *Ziziphus mauritania* respectively. The crude protein content of *Balanites aegyptiaca* (13.64%) recorded in this study is lower than the value 14.79% reported by Abbator (2012). The crude fibre, Ether extract and Ash content of *Balanites aegyptiaca* obtained in this study were 25%, 1.0% and 2.0% respectively which were lower than the values 26.50%, 3.75% and 3.50% respectively reported

by Abbator (2012). *Ziziphus mauritania* had a crude protein content of 13.64% which is slightly higher than 12.66% reported by Njidda and Ikhimoiya (2010). However, the crude Protein content of *Ziziphus mauritania* in this study is lower than the value 18.2% reported by Booth and Baldwin (2022). Sampling procedure and collection period might be responsible for the variation in the composition of the crude protein content. The crude fibre content recorded for *Ziziphus mauritania* in the present study is similar to the value reported by Abbator (2012).

Table 1: Chemical Composition of *Balanites aegyptiaca* and *Ziziphus mauritania* (%DM)

	Balanites aegyptiaca	*Ziziphus mauritania.*
DM	95.4	96.6
CP	13.64	13.64
CF	25.00	24.00
EE	1.00	2.00
ASH	2.00	3.00

DM= Dry matter
CP-Crude protein
CF-Crude fibre
EE-Ether extract.

The chemical composition of browse mixtures is shown in Table 2. The dry matter content of the browse mixtures at the ratio of 1:1, 1:2 and 1:3 were 95.6., 95.8 and 96.2%, respectively. The crude proteins content were 14.34 14.40 and 18.20%. For 1:1, 1:2 and 1:3 ratios. The crude protein content of the diet increased with increase in the proportion of *Ziziphus mauritania.* The Crude fibre content ranged between 24 and 259% the lowest level was recorded in ratio 1:2. The ether extract value varied from 1 to 3%. The highest value was recorded in ratio 1:3.

Table 2: Chemical Composition of Browse Mixtures (% DM)

Parameters	DM	CP	CF	EE	ASH
Balanites aegyptiaca and *Ziziphus mauritania*	95.6 1:1	14.34	25.00	1.00	3.00
Balanites aegyptiaca and *Ziziphus mauritania*	95.8 1:2	14.40	24.00	3.00	3.00
Balanites aegyptiaca and *Ziziphus mauritania*	96.2 1:3	18.20	25.00	4.00	3.00

DM= Dry matter
CP--Crude protein
CF-Crude fibre
EE-Ether extract

The results of dry matter intake, digestibility and body weight gain in goats fed browse mixtures is shown in Table 6. There were no significant differences in dry matter intake (P>0.05) between treatments B, C and D. Treatment A was significantly different from treatments B, C and D. Dry matter intake was highest for treatment D. and is similar to the value 641.37g/day reported by Njidda and Ikhimoiya (2010) who fed browse as a sole diet. The lower dry matter intake recorded for treatment A could be due to the high crude fibre content of the diet. Faecal nitrogen output (g/day) was highest for treatment C (1.74g/day) and lowest for A (0.96g/day). There was no significant difference (P>0.05) between the treatments. Weekly live weight gain (kg) was highest for treatment D (0.30kg/week) and lower for

treatment A (-0.75kg/week), which differed significantly (P<0.05) from treatments B, C and D. Daily live weight gain (g) was higher for treatment D (40.00g/day) and lower for treatment A (-107.50g/day). There were no significant differences (P>0.0S) between treatment B, C and D. Treatment D had the highest daily weight gain (40.00g/day). This might be due to the high crude protein content of the diet. Feed conversion ratio (g) was best for treatment D (4.47) and poorer for treatment A (-0.89). This indicates that goat fed treatment D had efficient utilization of nutrients. There were no significant differences (P>0.05) between B, C and D. Dry matter digestibility (%) was highest for treatment D (77.69%) and lowest for treatment A. The dry matter digestibility of the browse mixtures was higher than the control (65.76%). There were no Significant differences (P>0,05) in dry matter digestibility between treatments B, C and D. Nitrogen intake and retention in goats fed browse mixtures is shown in Table 7. Nitrogen intake differed significantly (P<0.05) between the treatments and was highest in D (17.54g/day). This might be attributed to the high crude protein content of the diet. Faecal output was highest for treatment C (155.47g/day) and lower for treatment A (123.69gday). There were no significant differences (P>0.05) between the treatments. Urinary nitrogen (N) output values recorded for different diets were 5.89.5.02, 4. 48 and 4.98g/day for treatments A, B, C and D. Treatment A was significantly different (P<0,05)

from the other treatments. Nitrogen retention differed significantly (P<0.05) between the treatments and was highest in D (11.09g/day) and lowest in A (1.53glday). Goats fed on the browse mixtures had positive nitrogen balance. This had demonstrated that the browse mixtures were efficiently used as fermentable nitrogen sources for microbial growth in the rumen, therefore, yielding more microbial amino acids.Nitrogen retention is associated with the amounts of nitrogen used for protein deposition and biological value is a measure of protein quality (Quinion et al., 1996).

Table 3: Nitrogen Intake and Retention (g/day) in Goats Fed Browse Mixtures

Parameters	Treatments				
	A	B	C	D	SEM
Feed Nitrogen intake	8.39c	13.43b	13.73b	17.54a	0.49
Faecal Nitrogen output	0.96c	1.19c	1.74a	1.46b	0.12
Urinary Nitrogen output	5.89a	5.02ab	4.48b	4.98ab	0.49
Nitrogen Retained	1.53c	7.22b	7.53b	11.09a	0.69

a,b,c = means in the dame row having different superscripts differ significantly (P<0.05).
SEM=Standard error of mean.
A,B,C and D=Treatments

CONCLUSION

In conclusion, the goats fed on *Balanites aegyptiaca* and *Ziziphus mauritania* mixed at ratios 1:1, 1:2 and 1:3 had high dry matter intake and this resulted in optimal nitrogen intake and nitrogen retention. This showed that diets used in this study were adequate in nitrogen especially the mixtures which can help to maintain the live weight of ruminant t animals most especially during the dry season. The browse mixtures (*Balanites aegyptiaca* and *Ziziphus mauritania*) could be used as alternative low-cost protein supplements for feeding ruminant livestock during the dry season.

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